

**Hoover Dam and Visitor Center Year 2000 (Y2K)
Embedded Microchip (EMC) Inspection
June 4-5, 1998
Final Report**

Introduction/Summary

The EMC Technical Advisory Group (TAG) and four regional EMC representatives met at Hoover to gain a better understanding of the types of equipment and devices that contain EMCs which could cause problems for the year 2000, and in limited cases, the year 1999. Discussions reinforced existing knowledge, or added to the understanding of the coordinators and EMC TAG. As a result, both groups will be better able to provide assistance and support to field offices for EMC identification and testing.

Although there are a large number of EMC devices in service at Hoover (more than 200), the number of non-compliant devices (approximately 30) is relatively low. Although this is only 15 percent, it nonetheless is a number not to be taken lightly, since only a few non-compliant devices could seriously impact operations. Several factors account for the low percentage of non-compliant EMC devices. First, Hoover was built in the 1930s which is certainly pre-microchip. Secondly, the control center and visitor center have just been updated and most of these newer devices are compliant. Third, since it is a critical facility, the staff has been diligent about replacing non-functioning or outdated equipment. Given the importance of Hoover dam operations and any potential year 2000 problems, extra staff has already been scheduled to be at the site or on call in case problems arise.

Categories were made for the purposes of organizing report information; however, there are functions of many devices which overlap categories. For example, the Supervisory Control and Data Acquisition (SCADA) system includes some monitoring functions and data collection and management.

Persons Who Attended the Inspection

Mike Eaker, an EMC TAG member, LCD Office, provided a summary of activities to date and a description of the facilities and devices containing EMCs. The following list includes persons attending the inspection:

Jim Sewell (EMC TAG member, D-8460, instrumentation)
Lee Matuszczak (EMC TAG member, D-8450, hydroelectric research)
Lisa Gamuciello (EMC TAG member, D-8440, electrical systems)

Dick Dye (GP EMC Regional Coordinator)
John Walp (EMC TAG member, D-8410, mechanical equipment)
Dave Winslow (UC EMC Regional Coordinator)
Becky Redhorse (EMC Activity Coordinator)
Frank Cabading (MP EMC Regional Coordinator)
Cliff Cunningham (LC Y2K Regional Coordinator)

Visitor Center

The digital theater system has several programmable logic controllers (PLCs), a computer with software that controls lighting and other climate conditions, show controllers, etc. which are all Y2K compliant. The system's software is Windows 95 which is compliant with a small fix, and the system uses the computer's hardware clock to operate so it will not be a problem. More specifically, although the computer hardware clocks are usually not compliant, the motherboard BIOS software and Windows 95 will usually compensate for the errors in the hardware. However, the heating, ventilation, and air conditioning (HVAC) controls are not compliant, and there is no resolution from the company. Part of the problem is that Reclamation is in a lawsuit with the contractor that constructed the visitor center, and as a result Reclamation cannot get as-built prints. The center's elevators use hydraulics for operation so they are expected to be compliant.

Monitoring Equipment

Although this section discusses monitoring equipment, the monitoring devices can be integrated into the equipment used to control the power plant operations. For example, commands come through the SCADA system, then go through the remote terminal units (RTUs) which then control the power turbines. These devices are also used to monitor many of the critical quantities in the power plant.

Mike was asked if any piezometers or similar monitoring equipment used EMCs, and he responded that it is all electromechanical. However, he mentioned the Dwyer temperature monitor or controller which can shut things down; the temperature controllers are compliant. The temperature controller communicates with the Netpacks (a specialized RTU or remote data collection device) at the units and a QNIX-based data collection system to archive and monitor temperatures for the generators at Hoover, Parker and Davis Dam. Not all components of the data collection system are compliant. The clock could be rolled back to an earlier year; however, Mike is relying on the vendor to develop a solution.

The group questioned why the facility has no sequence of event recorders (SOEs). Mike

explained that the power customers, which function much like a board of directors, could see no immediate need and return on investment dollars for the devices. As a result, the RTUs are used for sequence of event recorders (SOEs) and provide 10 millisecond time stamping in the SCADA system.

Data Collection and Management

There are Sutron devices situated at various locations from Hoover Dam south to Mexico. The Sutron devices collect river flow, rain fall, turbidity, salt content and other mission critical data from the Lower Colorado River and send it via microwave links to the central Data Management System (DMS). The Sutron data collection units are compliant, the DMS hardware is compliant, and the DMS software is not. The system is mission critical since it documents where the water goes and there is, presently, no contingency plan for its failure.

The GE Harris RTUs used in the SCADA system are compliant. Hoover power plant and the downstream facilities at Parker and Davis dams have a total of about 40 RTUs installed. A principal function of these RTUs is to assist the project in meeting power demands.

Jem meters, which meter power delivery from Hoover, Parker, and Davis for revenue purposes, are not compliant; however, their date functionality is not important to the data collection since the SCADA system keeps track of power delivery dates.

The Accusonic water flow meters that provide numbers for water optimization are not compliant, and will also fail for the year 1999. The meters fail in 1999 since manufacturers in the 1970s did not expect them to last to the year 2000, and 99 was used as an error code. New flow meters (15 total) have been ordered and should be received and installed by the end of July at a cost of about \$250,000. There are three meters at Davis Power plant, two at Parker Power plant and ten at Hoover Dam.

Local Area Network (LAN) Analyzers are used for quickly locating problems in one or more of the many network nodes in the system. At this point, Mike is not sure if the non-compliance is a hardware or software problem, but the hardware does contain an EMC. The contingency plan is to replace the analyzer at an estimated cost of \$27,000. There was some question among the group and from Mike whether this should be classified as a communication or software Y2K issue for Kent Rosenlof's purposes or if it is an EMC concern. Mike sent the information for the analyzer to Kent Rosenlof.

Power Operations

An air compressor is used to depress water out of the turbines to reduce friction, allowing them to turn easily (without consuming excess power) when used for condensing purposes. The ability to condense units is very valuable to Hoover dam operations for several reasons. First, condensing units help with voltage support throughout the power grid. Second, units in condense mode can be used almost immediately for power generation. This is one of the most valuable economic benefits of hydro generation. Third, condensing units makes it possible to operate other generators at the same power plant at a more efficient operating point which means more power using less water. The air compressors are compliant; however, the personal computer-based control and monitoring system is not. The system uses the motherboard hardware chip as the time basis. The basic input/output system, also known as BIOS, software does not deal properly with the Y2K rollover. The vendor has been contacted about the problem, but no solution is available yet.

Relays protect the power lines in case of faults such as airplane accidents that bring down lines, lightning which may strike the lines, etc. The Optimho relays are not compliant.

Data Exchange

There are only two data exchange points between Hoover Dam and other agencies. The first is to Western Area Power Administration's (WAPA) control center in Phoenix. The second is to the unmanned Bureau of Indian Affairs (BIA) facility at Headgate Rock. Both communications links are compliant. WAPA has requested certification from Reclamation that its link to Phoenix is Y2K compliant.

Communications

The facility has redundant communication systems, with both microwave and fiber optics based systems in service. The facility is also self-reliant since phone companies find it cost prohibitive to provide remote service. A third avenue for communication is provided by a hand-held satellite phone. Both the microwave and fiber optic systems link Hoover to the Parker and Davis facilities and to Boulder City. The systems are all compliant with some minor exceptions. A Rockwell DML 3X50 fiber multiplexer which combines communication channels into a single signal is not compliant. Estimated cost of replacement is \$1,700 per unit and plans are to replace it next month with a new Synchronous Optical Network System (SONET) presently being installed and tested. The satellite PBXs telephone switches at Davis, Parker, and Mead Substations are compliant. The voice mail system is not compliant, and will be replaced in 1999 at an estimated cost of \$15,000.

A DS3 analyzer, which is a piece of test gear, is not compliant but will continue to run after the year 2000. This device is used for diagnostic purposes in maintaining the digital Microwave and Optical carrier systems.

Power supplies for several communications devices were found to have internal clocks. These clocks are used for alarm reporting purposes and the date information is not critical to their operation.

The WAN Router at Hoover, an E-mail router, CISCO 7000 is not compliant and will cost an estimated \$23,000 to replace. If the unit fails, E-mail would not get through. The router was another gray area in terms of whether it is considered strictly a communication item for Kent Rosenlof's data gathering purposes, or if it is an EMC device, or both.

Safety Systems

The 7200 series fire alarm system at Hoover is a relatively simple system and is compliant since time is irrelevant for its functioning.

Hoover's two year old, elaborate security system uses time and date stamping on recorders which is compliant for 32 cameras and related equipment. However, an analog recorder for recording threatening phone calls and police dispatch is not compliant. Plans are in place to replace the recorder. Replacement cost is estimated at \$17,000.

All elevators use pre-microchip technology. Some discussion ensued about elevators that do use date functions, but Mike Eaker explained that dates are for recording and maintenance purposes only and would not affect operations.

Automatic light-dimming for the visitor center parking lot is not compliant since it relies on a computer program with time, date, and year for sunset and sunrise timing. Plans are to fix it or roll back the clock to, say, 1980 so that the program will continue to function until a more permanent solution can be placed in service.

The card key systems may or may not be compliant, but they have a manual override.

Conclusions

During the closing session, several topics were discussed:

1. Poor responses are being received by the regional coordinators from area offices and they are wondering what actions could be taken to remedy the situation.
2. Mike Eaker shared a LAN message he received from the Department forwarded by Kent Rosenlof that seemed to indicate that Reclamation will have to hire contractors for the independent verification of compliancy. The group was wondering if this is true and if it is now a mandate.
3. It was noted that some systems were described during the inspection which were not compliant and for which there were no contingency plans. As a result, it was suggested that an outcome of the inspection and report be recommendations for those devices.
4. Another observation from the inspection included several gray areas between communications and EMC categories, and the issue should be addressed as an outcome of the Hoover inspection.
5. Some regional coordinators were concerned about estimating area- or region-wide contingency planning costs since the figures would require upper management reviews. Coordinators felt that they may be subjected to additional scrutiny by management because of the lack of funds.
6. Mike was asked how he was able to replace the number of devices already in place or that are about to be installed. Funds from several years past were used since he puts in budget requests for miscellaneous repair and replacement each year.
7. Several coordinators pointed out that there is no funding provided for Y2K activities, and as a result small offices are having difficulty affording the effort required to investigate and/or solve Y2K problems.

Recommendations

General Recommendations

The Y2K problem is very pervasive. Reclamation and its partners need to look at everything possible to insure that we are not going to suffer from Y2K-related failures in the new millennium. What we learn from these investigations is that almost every modern convenience may be operated by an EMC. At the same time, Washington DC is becoming increasingly concerned about the problem. Early preparation and finding solutions will avoid future problems and expenses.

Most Y2K compliance work on Hoover has already been occurring which is important since the year 2000 is only 18 months away. Insuring that systems are thoroughly evaluated and compliant in the next few months will save the operators many hours of extra time, expense, and stress that will be necessary if last minute actions must be taken.

Specific Recommendations

1. Poor responses from field offices may be solved with additional funding, but that may not happen. Reclamation staff assigned to Y2K efforts must be able to show due diligence, which means paper trails. The recommendation is to send E-mail messages (and save them), memos, and make telephone calls (log them) to field offices repeatedly -- daily if necessary to get the responses needed.
2. Will independent certification contractors be required for EMC work? Perhaps. The Department of the Interior (DOI) seems to be leaning in that direction, and for that reason, Reclamation is considering the possibility of using the EMC TAG as its independent verification team.
3. Although there are efforts underway for the following noncompliant devices, some general recommendations are offered:
 - a) Visitor Center -- HVAC. Heat in January may be important for public welfare. Securing the as-built-plans from the contractor would certainly be helpful and should be a priority in addition to contacting the vendors of the components used in the system.
 - b) Monitoring -- temperature controller. Continuing to contact the vendors is recommended to ensure that they will have fixes or replacements.
 - c) Data collection and management -- DMS software. The same recommendation is suggested here as for item b.
 - d) Power operations -- protection relays and personal computer-based air compressor

control and monitoring system. The vendor for the Optimho states that versions A,B, & C software will cause the relay to display 19:0; however, there is no effect on the protection functions of the relay, and it is easy to correct the faulty display by entering the calendar clock section of the relay menu, according to their website information. If the vendor for the air compressor system does not have fixes or replacements, it may be wise to investigate other sources for replacements.

e) Communications -- CISCO E-mail router. The device falls under systems or telecommunications, and should probably be replaced.

In addition to the device-specific contingency plans being developed, Reclamation should develop general contingency plans that could apply to all or most major facilities in case something is missed.

4. Gray areas between telecommunications and other Y2K data collection and EMC data collection has been resolved. Video, radio, voice, and data collection equipment is telecommunication equipment, and although they may have EMCs, they are categorized as telecommunications. In the Hoover case, this would include the LAN analyzers described in the 'Data Collection and Management' section, and all equipment discussed in the 'Communications' section, including the test gear. However, if there are any questions about whether the device/equipment should be classified as systems, telecommunications, or EMC, please contact a regional coordinator in one of these areas; otherwise, contact Rebecca Redhorse, Y2K EMC Administrator, Anthony Juarez, Y2K Telecommunications Coordinator, or Kent Rosenlof/Chris Zehnle, Y2K Systems Coordinator.

5. When estimating contingency plan costs, assume the worst. EMC Coordinators, operators and managers should ask the question: How much will it cost us to operate manually if we cannot fix the problems? The estimate should include all equipment, labor, travel, and extra communication costs.